



# Equilibrium capital taxation in open economies under commitment<sup>☆</sup>



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## ABSTRACT

This paper analyzes equilibrium capital taxation in open economies with strategic interaction in a neo-classical growth model. Under perfect commitment, I show that non-cooperative capital taxes are zero in the long run for a large open economy, thereby generalizing the result previously established only for the special cases of a closed and a small open economy. This does not represent a race to the bottom, though, since the result is independent of the degree of capital mobility, the number of countries, or a country's size relative to the rest of the world. Moreover, when countries cooperate, they still set capital taxes to zero in the long run. These outcomes are robust to different equilibrium specifications, the inclusion of endogenous government spending, and heterogeneous agents and non-linear labor income taxation. Governments find it optimal to implement the efficient capital allocation in the long run, both in a closed and an open economy; this trumps incentives to tax foreigners' domestic capital holdings by raising capital taxes and attracting capital from abroad by lowering capital taxes.

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## 1. Introduction

The taxation of capital is an important and hotly debated policy issue, including within the economics profession. The benchmark result was established by Chamley (1986) and Judd (1985): capital taxes are optimally zero for a closed economy. The world today, though, is not well described by a closed economy; capital is highly mobile between countries. Does the argument for zero capital taxes change in an open economy? Correia (1996) extends the result to a small open economy.<sup>2</sup> But the literature so far has abstracted “from interesting strategic issues that arise when more than one authority sets taxes, and [...] from general equilibrium linkages between an economy's fiscal policy and world prices (Chari and Kehoe, 1999, p. 66).”

A closed and a small open economy are the limiting cases of a large open economy, where the relative mass of the home economy compared to the world economy is one and zero, respectively. If optimal capital taxes are zero in both the extremes of a closed and a small open economy, one could think that the intermediate case of a large open economy would yield the same result. But there are reasons why capital taxes could be zero only in the limiting cases: On the one hand, a large

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<sup>2</sup> Mendoza and Tesar (2005) analyze capital taxes in a large open economy, but assume for computational reasons time-invariant tax rates, which is driving their results. Klein et al. (2005) and Quadrini (2005) study capital taxes without commitment.

economy can influence the world interest rate and thus shift some of the tax burden on foreigners as well as directly tax their capital employed in the home country, see for example [Ha and Sibert \(1997\)](#).<sup>3</sup> On the other hand, capital mobility provides an incentive to lower capital taxes to attract foreign capital (or prevent capital flight), thus raising (or preventing the fall of) domestic wages. Furthermore, the observation that “zero capital income taxation in the steady state is optimal if the extra constraints do not depend on the capital stock” ([Chari and Kehoe, 1999, pp. 4041](#)) does not necessarily hold in a large open economy with strategic interaction.

In this paper, I take the conventional framework of a neo-classical economy to analyze non-cooperative equilibrium capital taxation in a large open economy. Capital is mobile between countries, while labor is not. Agents from each country can invest capital in any country (potentially subject to adjustment costs). I use best-response functions of a one-shot game between governments for a given belief of policies abroad to determine optimal policy.<sup>4</sup> *With perfect commitment, governments set capital taxes to zero in steady state.* The steady-state assumption can be relaxed; similar to the findings of [Judd \(1999\)](#) for a closed economy, countries set capital taxes to zero on average in the long run.

The interaction between governments is modeled as a one-shot generalized game. In consequence, only the equilibrium is feasible. In order to allow off-equilibrium behavior to be feasible, I propose an alternative framework where each country's labor taxes (or capital taxes) adjust to balance the government budget constraint for given bond issuance and capital tax (or labor tax) decisions. Capital taxes are still zero in the long run, even when other governments do not behave optimally. This framework also permits to consider mixed-strategy equilibria; these are all characterized by zero steady-state capital taxes. To ensure that governments are not restricted by the Laffer curve, government expenditures can be endogenized (so that the set of feasible strategies is always non-empty for all foreign strategies) without changing conclusions.

Results are also robust with respect to (i) the size of the economy compared to the rest of the world and the number of countries; (ii) differences between countries regarding the production technology, government outlays, and utility function parameters<sup>5</sup>; (iii) the inclusion of capital adjustment costs, which one could interpret as barriers to capital mobility; and (iv) agent heterogeneity regarding initial wealth and labor productivity, coupled with non-linear labor income taxation.

In contrast to the tax competition literature – starting with [Wilson \(1986\)](#), for an overview see [Nicodème \(2006\)](#) – zero capital taxes are not caused by a race to the bottom, since they are independent of the size of the country or the barriers to capital mobility. When countries cooperate, they also choose to set capital taxes to zero in the long run.

The organization of the rest of the paper is as follows: in the next section I set up the model and provide a proof of the main result, that steady-state capital taxes are zero in a large open economy. The third section discusses the robustness of the result. The last section concludes. The appendix contains proofs of propositions in the robustness section.

## 2. Model

The model consists of two countries for ease of exposition, it is easy to extend the model to any number of countries.<sup>6</sup> Agents can freely shift capital between countries, whereas labor is immobile. Barriers to capital mobility do not affect results, see [Section 3.5](#).<sup>7</sup> I will first analyze one country and discuss some of the conditions that have to hold in the other country later. Variables with an asterisk denote foreign quantities or prices. In this section, I first briefly describe the agents of the model, then define the game between governments and agents, and prove that capital taxes are zero in steady state, both in a non-cooperative and a cooperative equilibrium. I employ the so-called dual approach; the reason is that not all prices can be eliminated (since foreign taxes and bonds cannot be influenced).<sup>8</sup>

### 2.1. Agents

There is a continuum of identical households<sup>9</sup> and firms and a government populating each country. Heterogeneous agents who differ in labor productivity and wealth do not affect results, see [Section 3.6](#), with linear or non-linear labor-income taxes.

<sup>3</sup> They use an overlapping generations framework with time-consistent taxes and inelastic labor supply and find that corporate taxes (territorial taxes in this model) are optimally positive for capital importers and negative for exporters, in line with earlier results from static models.

<sup>4</sup> In order to examine the perfect-commitment benchmark equilibrium, one has to consider a one-shot game. However, as I show in [Section 3.2](#), governments would not change their steady-state capital taxes after observing other countries' policies.

<sup>5</sup> The time discount factor is an exception. When discounting differs across countries, a steady state or stable long-run average does not exist.

<sup>6</sup> Without loss of generality, I abstract from population and productivity growth. A stationary transformation is possible here, as in [Mendoza and Tesar \(2005\)](#). As in their paper, exogenous growth means that tax policy can only have level effects but does not affect long-term growth. For simplicity, depreciation is not considered but could easily be incorporated.

<sup>7</sup> Having agents invest their assets with investment firms which then allocate assets between government bonds and capital at home and abroad does not affect the paper's conclusions. Note that in the current setup the amount of capital each agent holds in each country is not pinned down (unless one adds capital adjustment costs). The total assets owned by each household and how much total capital is invested in each country is determined, however, which is what matters and which is also what one obtains from a model with international investors.

<sup>8</sup> One can show that an implementability constraint for the domestic, but not the foreign, household can be derived.

<sup>9</sup> Without loss of generality I assume that the measure of households is one for the home country. The relative size of the other country is  $\chi$ .

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